A Data Science Approach of Similarities and Differences Between Chicago Communties and Their Relationship with Community Average Income

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Introduction

City of Chicago

Introduction

- First let's consider this question. Imagine in some city, if someone is looking to open a restaurant, where would you recommend that they open it? Similarly, if a contractor is trying to start their own business, where would you recommend that they setup their office?

- By first looking at it, this could be a very complicated problem. One needs to do a lot of research, get familiar with the city, find relavant informations online, drive around ask local people, etc. But what if you want an easier method to get it done, which can make sure you don't miss a spot? This is where data science kicks in.

- In this project, we will take the city of Chicago as an example. We will first get all the community areas and neighborhoods in the city of Chicago, then we will get the coordinates of them. After that, we will use the API from Foursquare to extract the most visited venues in each community area. Then we will use unsupervised machine learning method - k-means to devide the communities into several clusters. You will see the similarities and differences between then. Last but not least, we will do some analysis on the data, and use the income data from Chicago Data Portal to help us figure out the deep relatinship between popular venues and communities' characters.

Get Our Dataset No. 1

- In this part, I will use the Foursquare location data to solve the problem and execute my idea.
- First we need to get all neighborhoods in Chicago. I used BeautifulSoup to scrape data from wiki page. https://en.wikipedia.org/wiki/List_of_neighborhoods_in_Chicago

List of neighborhoods in Chicago

From Wikipedia, the free encyclopedia

There are sometimes said to be more than 200 **neighborhoods in Chicago**,[1] though few residents would agree on their names and boundaries. A city ordinance prescribing and mapping 178 neighborhoods[2] is almost unknown and ignored even by municipal departments. Neighborhood names and identities have evolved over time due to real estate development and changing demographics.[3] The City of Chicago is also divided into 77 community areas which were drawn by University of Chicago researchers in the late 1920s.[4] Chicago's community areas are well-defined, generally contain multiple neighborhoods, and are less commonly used by city residents.[3][5] More historical images of Chicago neighborhoods can be found in Explore Chicago Collections, a digital repository made available by Chicago Collections archives, libraries and other cultural institutions in the city.[6]

Contents [hide]

List of neighborhoods by community area [edit]

Neighborhood	Community area
Albany Park	Albany Park
Altgeld Gardens	Riverdale
Andersonville	Edgewater
Archer Heights	Archer Heights

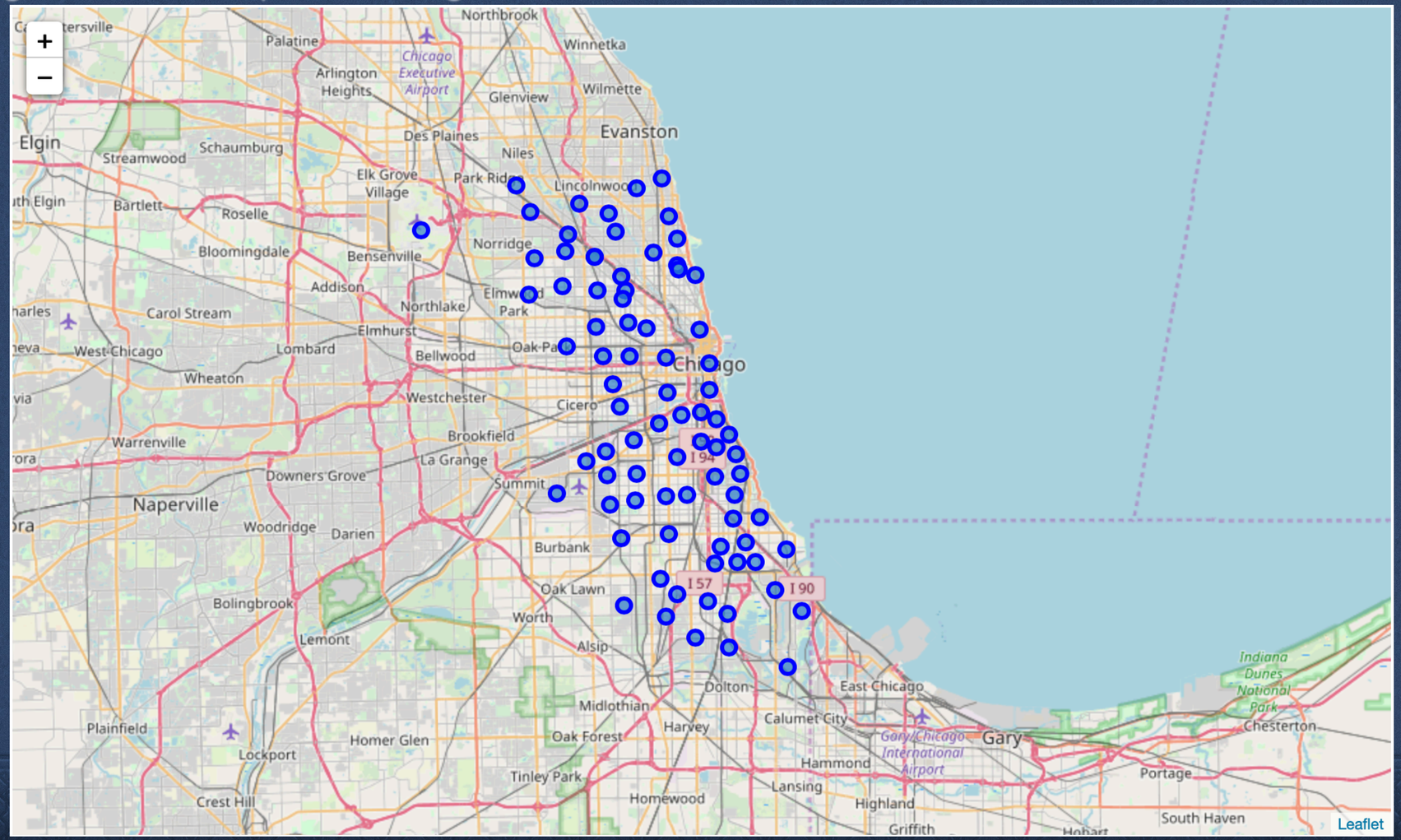
Get Our Dataset No. 1

- Here the preprocessing steps:
- 1) Group the neighborhoods based on their community area.
- 2) Get the coordinates of all these community areas.
- 3) Manually add missing coordinates by simply searching them in google.
- 4) Corrected one error coordinate.

	CommunityArea	Neighborhood	Latitude	Longitude
0	Albany Park	Albany Park, Mayfair, North Mayfair, Ravenswoo...	41.9719	-87.7162
1	Archer Heights	Archer Heights	41.8114	-87.7262
2	Armour Square	Armour Square, Chinatown, Wentworth Gardens	41.84	-87.6331
3	Ashburn	Ashburn, Ashburn Estates, Beverly View, Crestl...	41.7475	-87.7112
4	Auburn Gresham	Auburn Gresham, Gresham	41.7505	-87.6643
5	Austin	Galewood, The Island, North Austin, South Austin	41.8879	-87.7649
6	Austin, Humboldt Park	West Humboldt Park	41.9025	-87.7361
7	Avalon Park	Avalon Park, Marynook, Stony Island Park	41.745	-87.5887
8	Avondale	Avondale, Jackowo, Wacławowo	41.9389	-87.7112
9	Avondale, Irving Park	Polish Village	41.9534	-87.7364

Get Our Dataset No. 1

- Now let's generate a map of Chicago with all communites.



Get Our Dataset No. 1

- Now we are ready to get all venues near each community. Here we use Foursquare database.
- Below is the table listing 10 most common venues in some each neighborhood.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Albany Park, Mayfair, North Mayfair, Ravenswoo...	Sandwich Place	Pizza Place	Donut Shop	Fried Chicken Joint	Bakery	Mobile Phone Shop	Gas Station	Diner	Chinese Restaurant	Bus Station
1	Andersonville, Edgewater, Edgewater Beach, Edg...	Bank	Asian Restaurant	Sandwich Place	Sushi Restaurant	Mexican Restaurant	Coffee Shop	Pharmacy	Antique Shop	Video Store	Mobile Phone Shop
2	Archer Heights	Mexican Restaurant	Mobile Phone Shop	Grocery Store	Gas Station	Optical Shop	Candy Store	Big Box Store	Bar	Bank	Bakery
3	Armour Square, Chinatown, Wentworth Gardens	Chinese Restaurant	Sports Bar	Hot Dog Joint	Breakfast Spot	Gas Station	Italian Restaurant	Asian Restaurant	Indian Restaurant	Sandwich Place	Grocery Store
4	Ashburn, Ashburn Estates, Beverly View, Crestl...	Construction & Landscaping	Cosmetics Shop	Light Rail Station	Italian Restaurant	Automotive Shop	Cuban Restaurant	Currency Exchange	Fish Market	Fish & Chips Shop	Filipino Restaurant

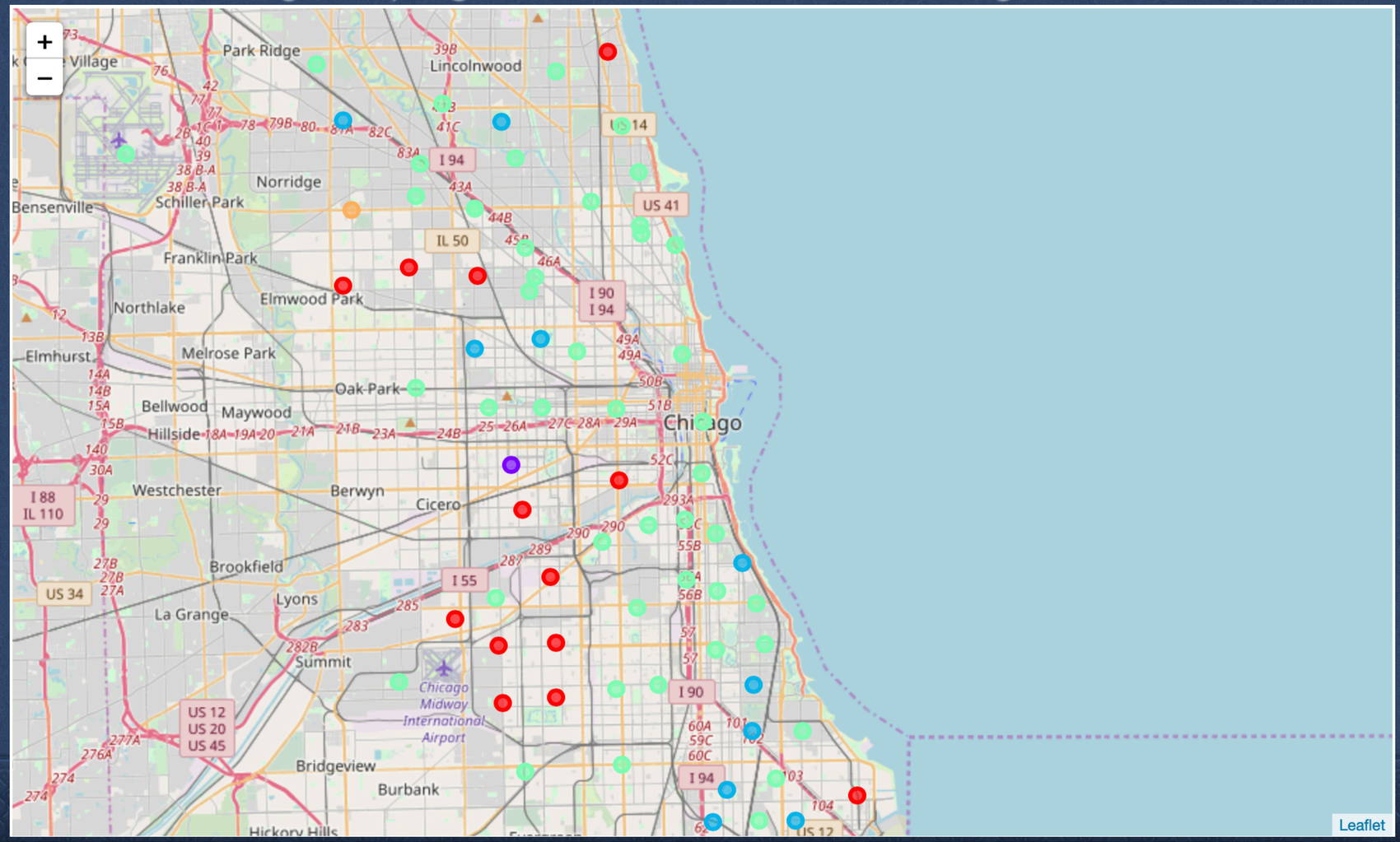
Analyzing Data with Machine Learning

- *We use unsupervised machine learning method k-means to cluster the communites into 5 clusters and see if there is anything interesting.*
- *All communities are devided into 5 clusters, namely cluster 0, 1, 2, 3, 4.*

	CommunityArea	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	Albany Park	Albany Park, Mayfair, North Mayfair, Ravenswoo...	41.9719	-87.7162	3.0	Sandwich Place	Pizza Place	Donut Shop	Fried Chicken Joint	Bakery	Mobile Phone Shop	Gas Station
1	Archer Heights	Archer Heights	41.8114	-87.7262	3.0	Mexican Restaurant	Mobile Phone Shop	Grocery Store	Gas Station	Optical Shop	Candy Store	Big Box Store
2	Armour Square	Armour Square, Chinatown, Wentworth Gardens	41.84	-87.6331	3.0	Chinese Restaurant	Sports Bar	Hot Dog Joint	Breakfast Spot	Gas Station	Italian Restaurant	Asian Restaurant
3	Ashburn	Ashburn, Ashburn Estates, Beverly View, Crestl...	41.7475	-87.7112	3.0	Construction & Landscaping	Cosmetics Shop	Light Rail Station	Italian Restaurant	Automotive Shop	Cuban Restaurant	Currency Exchange
4	Auburn Gresham	Auburn Gresham, Gresham	41.7505	-87.6643	3.0	Fast Food Restaurant	Lounge	Greek Restaurant	Pharmacy	Cosmetics Shop	Electronics Store	Ethiopian Restaurant

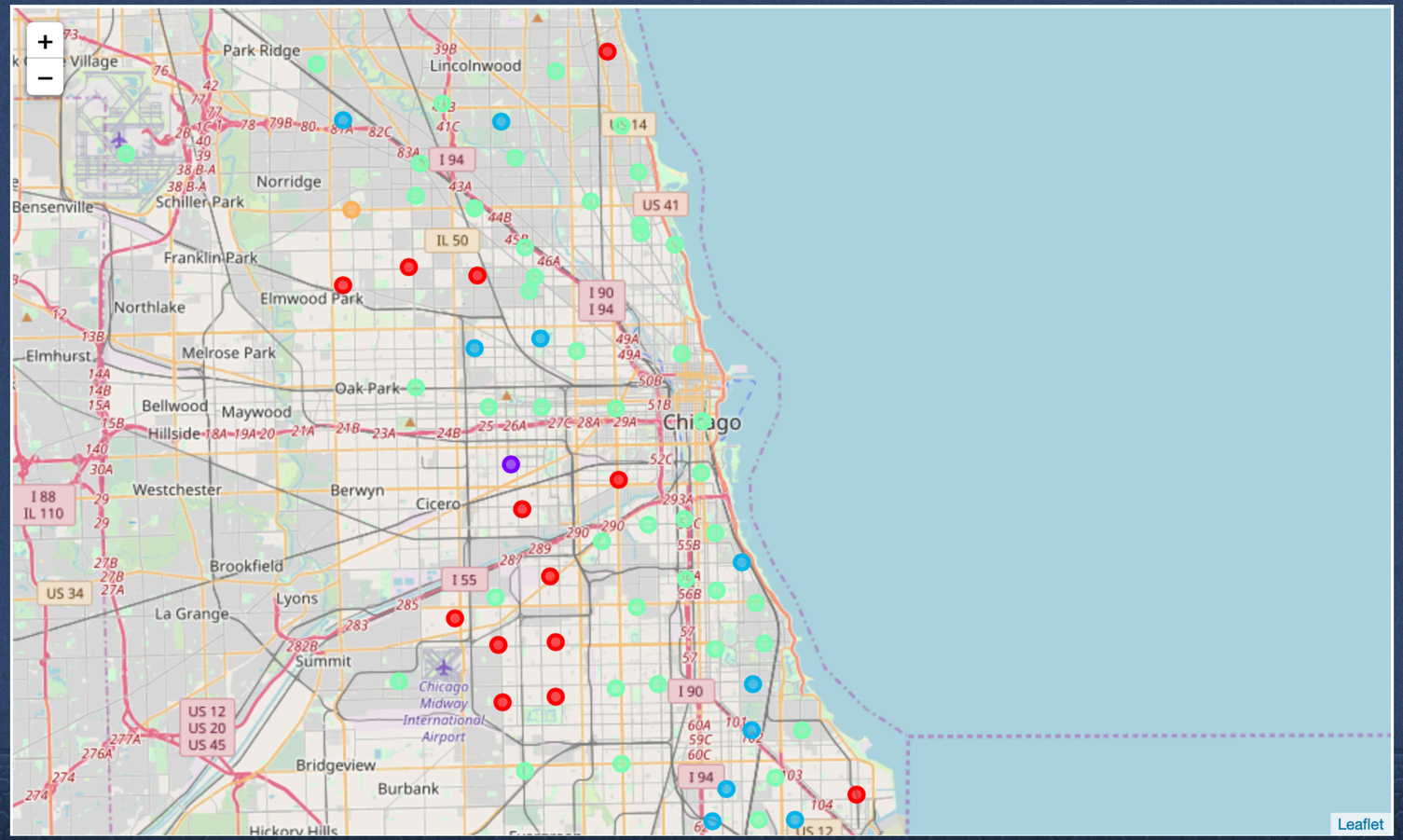
Analyzing Data with Machine Learning

- Now we create the Chicago map again with each clusters showing with different colors.



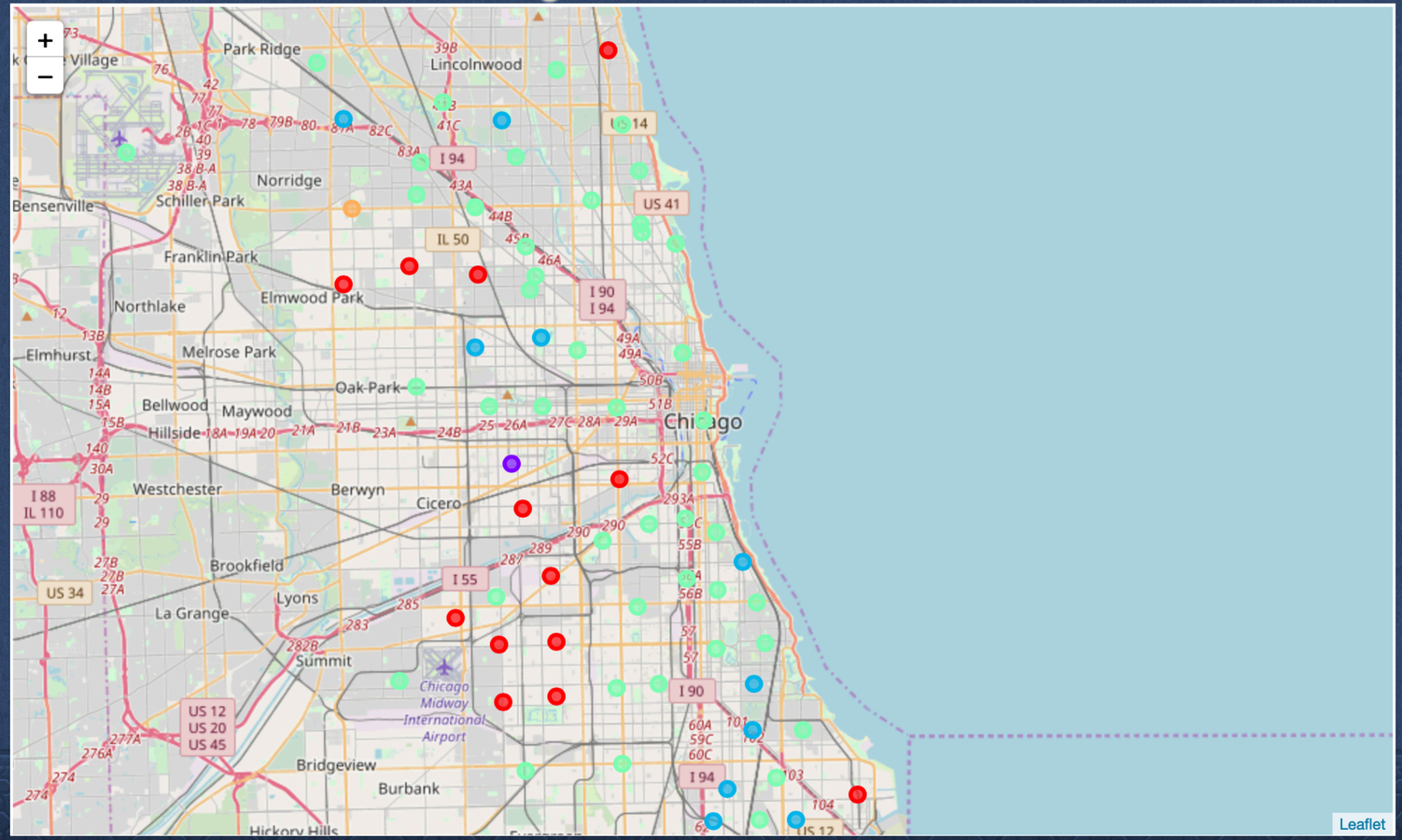
Analyzing Data with Machine Learning

- Chicago is an interesting city because it is distributed evenly from the very downtown to suburb.
- You can clearly see the green clusters are closer to the downtown, while red and blue clusters are in the suburb area.



Get Our Dataset No.2

- *Motivations: Based on my knowledge of the the city of Chicago, the red clusters are relatively poor residential communites, while the other clusters like green (closest to downtown) and blue are residential communites with above average income families.*



Get Our Dataset No.2

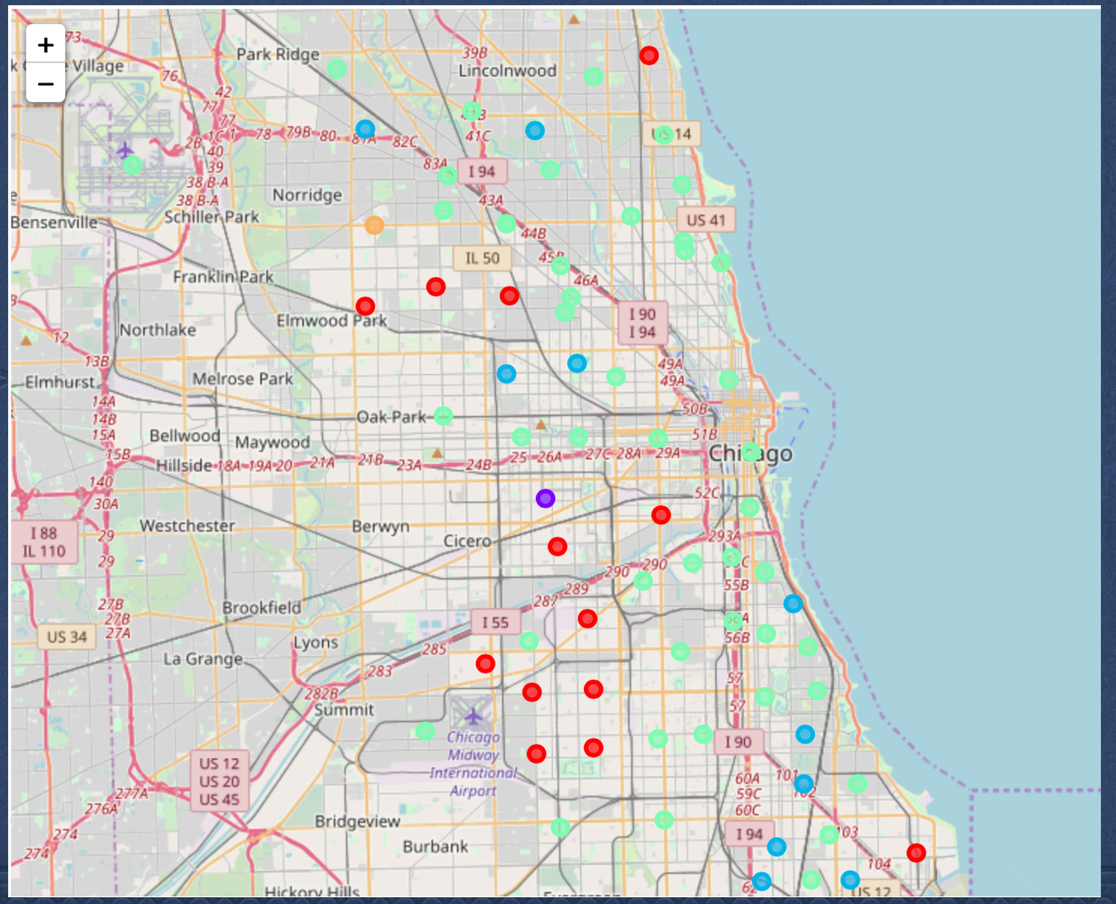
- It is hard to make that statement without data. So let's look at the data.¶
- I got the data from Chicago Data Portal. This data is imported and shown below.

	Community Area Number	COMMUNITY AREA NAME	PERCENT OF HOUSING CROWDED	PERCENT HOUSEHOLDS BELOW POVERTY	PERCENT AGED 16+ UNEMPLOYED	PERCENT AGED 25+ WITHOUT HIGH SCHOOL DIPLOMA	PERCENT AGED UNDER 18 OR OVER 64	PER CAPITA INCOME	HARDSHIP INDEX
0	1.0	Rogers Park	7.7	23.6	8.7	18.2	27.5	23939	39.0
1	2.0	West Ridge	7.8	17.2	8.8	20.8	38.5	23040	46.0
2	3.0	Uptown	3.8	24.0	8.9	11.8	22.2	35787	20.0
3	4.0	Lincoln Square	3.4	10.9	8.2	13.4	25.5	37524	17.0
4	5.0	North Center	0.3	7.5	5.2	4.5	26.2	57123	6.0

Get Our Dataset No.2

- *After some data processing, we got the average Income of each cluster. Let's also add the color of each cluster.*

Cluster Labels	Income	Color
0.0	16776.615385	Red
1.0	12034.000000	Purple
2.0	24601.125000	Blue
3.0	28283.836735	Green
4.0	26282.000000	Brown



Discussions

- *So the dataframe shown above agrees with my ealier assumptions. The red clusters are relatively poor residential communites, while the other clusters like green (closest to downtown) and blue are residential communites with above average income families. The Brown cluster only has one community, it is most likely very rich community. The Purple cluster only has one community, it is most likely very poor community.*

- *This is very interesting because we got the clusters from venues near each community. How would the venues near each community correlated to average income? Are centain stores/restaurant open more often in rich communities or vise versa?*

Discussions

- Let's find the most three counted venues in each cluster.¶

Cluster Labels	Income	Color	Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
0.0	16776.615385	Red	Mexican Restaurant	Mexican Restaurant	American Restaurant
1.0	12034.000000	Purple	Convenience Store	Yoga Studio	Donut Shop
2.0	24601.125000	Blue	Bus Station	Gymnastics Gym	Park
3.0	28283.836735	Green	Fast Food Restaurant	Pizza Place	Train Station
4.0	26282.000000	Brown	Deli / Bodega	Bar	Yoga Studio

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Discussions

- ***Key Observations:***
- ***Cluster 0,*** *which is a below average income community cluster, has a lot of Mexican Restaurant. This indites that these areas, which are most likely Mexican resident areas, are relatively poor.*
- ***Cluster 1*** *only has one community in there, so it may not represent too much. It has Convenience Store in the first place and Yoga Studio at the second place. Notice that Yoga Studio also exist as the third place in* ***cluster 4****, which also only has one community.*
- *In* ***cluster 3****, which is near downtown area, we see a lot of Fast Food Restaurant and Pizza Place, that's because this is a area mainly lived by single people who live in expensive condos and work in downtown area. They either don't have a kitchen in the apartment or don't have time to cook. So fast food restaurants and pizza places are polular.*
- *Blue* ***Cluster 2*** *is close to downtown but not that close. This is the area where above average income people with family live in. Many of them still work in the downtown center, but they buy houses in the area where it is cheaper than downtown so they can buy a bigger house. They still need public transportations to go to work, that explains why Bus Station is very common in these area. A lot of Gymnastics Gym indicates the people live here live more healthy and maybe happier. There are many parks in this area, which indicates this is a good area to live in.*

Ending/ Conclusion

- *So now we can help people who is looking to open a restaurant, and who is trying to start their own business. For example, if someone want to start a Mexican Restaurant, you'd better do it in one of the communites in cluster 0. But try to avoid the communites with too many Mexican Restaurant, becasue there may be a lot of competation. And if someone wants to open a gym, we could recommend to do it in one of the communites in cluster 2 because the people in this area are more likely to visit a gym from time to time.*

Thank you!